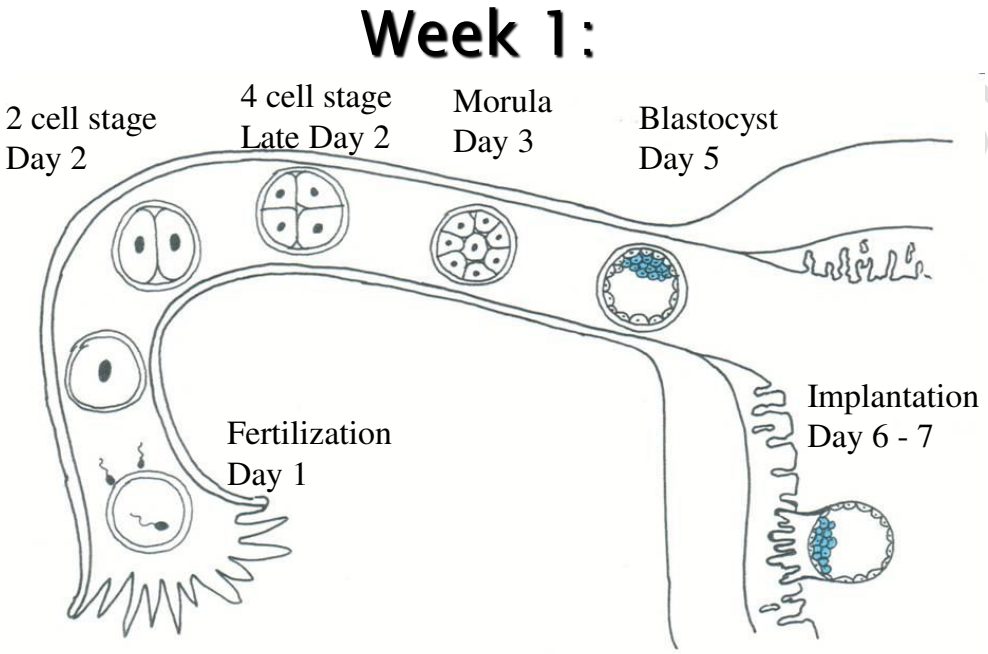
Embryology

Embryology is the science of the development of an embryo from the fertilization of the ovum to the fetus stage.

In human, prenatal development begins at the time of fertilization and continues until the birth of the child.



The female gamete or the ovum which contains haploid number of chromosomes (23)combined with the male gamete (sperm) which contains haploid number of chromosomes(23) in process called fertilization.The formed egg after fertilization is called zygote which contains diploid number of chromosomes (46=44 somatic chromosomes and pair of sex chromosomes).

How and when the different characters of the human being going to be determined?

It is going to be determined five hours after fertilization . The genetic coding for the shape and characters of each part of our body usually are coming partially from the father and partially from the mother.

Early Developmental Stages

Prenatal development consists of three distinct periods:

a. Preimplantation period: During the first two weeks.

b. Embryonic period : From the second to the eighth week.

c. Fetal period : From the 9th week till the end of Pregnancy(birth).

During embryonic period ***the embryo period is vurnable to many developmental disturbance caused by teratogens .These are environmental factors include infection, drugs, and radiation which cause malformation in the embryo.***

During the third week three germ layers present in the embryo, they are the ectoderm, mesoderm and endoderm.

Neural Crest*:* Also during the third week, another specialized group of cells, the neural crest cells, develop from the neuroectoderm.

Origin: These cells are originated from neuroectoderm during development of the CNS.

The neural crest cells migrate away from the neuroectoderm in a form of waves.

The migrations are initiated at about 4 week in human embryo.

These migrated cells have the capacity to differentiate extensively within the developing embryo to form many structures and cells in the head and neck and other parts of the body, including the branchial arches and their derivatives.

Embryonic connective tissue elsewhere is derived from mesoderm and is known as mesenchyme, whereas in the head it is known as ectomesenchyme.

In the human the period of migration is extending between 22-49 days. The primary target for the teratogens is the migrating neural crest cells.

Clinical Note: Developmental disturbances occur in meiosis during fertilization resulting in chromosomal abnormalities which lead to congenital malformations. One of these malformations is the Down syndrome or triosomy 21; an extra chromosome number 21 is present after meiotic division. Children with Down syndrome may have increased level of periodontal diseases and fewer abnormally shaped teeth. The arched palate and poor use of tongue muscles lead to an open mouth position and protrusion of normally sized tongue. Therefore articulate speech is often difficult

Implantation and gastrulation

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In humans, implantation is an event that occurs early in pregnancy in which the embryo adheres to the wall of uterus. At this stage of prenatal development, the embryo is a blastocyst. It is by this adhesion that the fetus receives the oxygen and the nutrients from the mother to be able to grow.

In humans, implantation of a blastocyst is most likely to occur about 7 days after ovulation.

By two weeks after fertilization cells from blastocyst starts secreting hormone called **Human chorionic gonadotropin** (HCGH).This hormone could be detected in mother's blood at end of first two weeks of pregnancy ,and in the urine of the mother at the end of first month of pregnancy (important for pregnancy test in the pregnant female).

Gastrulation : **Occurs at the third week of pregnancy.**

GASTRULATION is the process that establishes the three primary germ layers: ectoderm, mesoderm, and endoderm. All cell and tissues of the adult can be traced back to the three primary germ layers.

- **Embryonic ectoderm gives rise to the epidermis, central and peripheral nervous systems, the eye, and inner ear, and, as neural crest cells. The neural crest cells give rise many connective tissues of the head.**
- **Embryonic endoderm is the source of the epithelial linings of the respiratory and alimentary (digestive) tracts, including the glands opening into the gastrointestinal tract and the glandular cells of associated organs such as the liver and pancreas.**

Embryonic mesoderm gives rise to all skeletal muscles, blood cells and the lining of blood vessels, all visceral smooth muscular coats, the serosal linings of all body cavities, the ducts and organs of the reproductive and excretory systems, and most of the cardiovascular system. In the trunk, it is the source of all connective tissues, including cartilage, bones, tendons, ligaments, dermis, and stroma of internal organs.

Connective tissues of head and neck are derived from two sources:

1. Mesenchymal cells of mesoderm.

2.Ectomesenchymal cells of neural crest.

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